1999 Paper 5 Question 6

Compiler Construction

Explain a possible implementation method for Java-style or ML-style exceptions and handlers. [8 marks]

Consider a simple arithmetic expression e of abstract syntax:

$$e ::= x \mid n \mid e + e' \mid e - e' \mid e * e' \mid e/e' \mid -e$$

where x ranges over a set of (global) variables, addressable by name, and n ranges over integer constants. Write a procedure in pseudo-code or a language of your choice which takes an expression e and prints (one-per-line) stack-machine instructions of the form

```
pushvar  x
pushnum  n
add          ; pop two items and push their sum
sub          ; pop two items and push their difference
mul          ; pop two items and push their product
div          ; pop two items and push their quotient
neg          ; replace top item with its negation
```

which, when executed, have the net effect of pushing just the value of e onto the stack. Each line of code emitted should contain a comment giving the number of items on the stack after its execution, thus the first `push` and the last instruction would both be commented with "1 item". [12 marks]